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ABSTRACT

If any one fact has emerged consistently in the International Project for the Evaluation of Educational Achievement (IEA) studies of educational achievements, it is that achievement is related to a variety of factors in the home background of children. This is true so far as differences in the achievements of single students within a country are concerned. It is also true so far as mean score for different countries is concerned. Several questions can be posed with respect to these relationships. Firstly, how substantial are the relationships, both within and between countries? Are they merely "statistically significant," or are they of a size that has "practical significance?" Secondly, how stable are the relationships from subject matter to subject matter and from country to country? Are the factors that receive most weight as predictors of reading the same as the ones that receive most weight for prediction of science or of literature? Are the factors that are most predictive in the U.S.A. also most predictive in England or Iran or Chile? If not, what reasonable explanation can be offered for the differences? Thirdly, are the facts that are most predictive of individual differences also the ones that are most predictive of national differences? If not, why not? In spite of the modest correlations that we obtained for background variables, these seemed to be much more effective predictors than any of the items that described the school as an educational unit. [Reproduced from the best available copy.] (Author/JM)

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The Relation of School Achievements to Differences in the Backgrounds of Children

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The Relation of School Achievements to Differences in the Backgrounds of Children

Robert L. Thorndike

If any one fact has emerged consistently in the IEA studies of educational achievements it is that achievement is related to a variety of factors in the home background of children. This is true so far as differences in the achievements of single students within a country is concerned. It is also true so far as mean score for different countries is concerned. Several questions can be posed with respect to these relaionships. Firstly, how substantial are the relationships, both within and between countries? Are they merely "statistically significant," or are they of a size that has "practical significance?" Secondly, how stable are the relationships from subject matter to subject matter and from country to country? Are the factors that receive the most weight as predictors of reading the same as the ones that receive most weight for prediction of science or of literature? Are the factors that are most predictive in the U.S.A. also most predictive in England or Iran or Chile? If not, what reasonable explanation can be offered for the differences? Thirdly, are the factors that are most predictive of individual differences also the ones that are most predictive of national differences? If not, what reasonable explanation can be offered for the differences?

As a partial answer to the first question, we show in Table 1 the median correlation over all countries for a number of home and community variables. Correlations are shown with score in Reading Comprehension, Science and Literature Tests for groups of 10-year-

olds, 14-year-olds, and students at the end of secondary school. In addition, Table 2 shows the correlation for a weighted composite of the more predictive of these variables for each country taken separately. Table 1 shows which of the elements of home background taken singly showed some appreciable correlation with the achievement measures. Table 2 shows how much of a prediction was possible from composites of the variables, and how uniform the relationship was from country to country.

The median correlations in Table 1 are, in general, quite low. The two most predictive single items of information are father's occupation and number of books in the home, with correlations in the 20's for 10-year-olds and 14-year-olds, but smaller at the end of secondary school. Other items of information show even smaller correlations. Why are the relationships no more substantial than this? There are at least three main contributing factors. One relates to the crudeness of the data. Information was obtained from pupils by questionaire, and was typically reported in no more than five response categories. The response categories were chosen so as to be most effective over the whole range of countries being studied. Thus, the question on books in the home read

"About how many books are there in your home?
(Do not count newspapers or magazines) (Choose one)

A. None

B. 1 - 10 books

C. 11 - 25 books

D. 26 - 50 books

E. 51 or more books

To show some of the problems of using a questionaire item such as this internationally the proportions of responses are shown

below for 14-year-olds in India and in Sweden.

	India	Sweden
A	11.9%	0.9%
B	35.9%	2.0%
C	22.5%	7.0%
D	12.3%	18.3%
E	17.4%	71.8%

Though the five response categories serve to bring out very sharply the difference between India and Sweden in home circumstances, they are not well chosen to differentiate the size of home libraries in Sweden. Over 70% of the responses fall in a single category. Under the circumstances, the correlation of 0.27 found for Sweden should, perhaps, be considered rather surprisingly high. Many items involved groupings at least as coarse as the one illustrated.

Or consider the coding of father's occupation. The basic datum was the pupil's response to the instruction:

> Please write your father's occupation.--------On the lines below, describe his occupation as clearly as you can.
>
> _____

From the statement provided by the pupil, a coder assigned the occupation to one of not more than nine categories. The categories were specified by each national center in terms that made sense for that country. In the United States the categories were:

9 Professional, technical and kindred workers

8 Managers, officials and proprietors, including farm owners and managers

7 White collar workers

6 Skilled manual workers

5 Semi-skilled workers

4 Farm workers, fishery, forestry and kindred groups

3 Domestic and personal service workers

2 Laborers

1 Unclassifiable

0 Unknown

Scale values were empirically determined for each of the categories so as to maximize the correlation of the scaled variable with achievement. However, the basic categories were chosen more in terms of their demographic than of their psychometric relevance. Furthermore, coding was based on the limited and sometimes ambiguous information supplied by the pupil. The fact that an "Unclassifiable" category was required and was used for 13.6% of the 10-year-olds, 8.1% of the 14-year-olds and 6.4% at the end of secondary education in the United States serves to document the difficulty that coders experienced in working with the information that the questionnaire supplied them. Even so, in the U.S.A. the correlation for this scaled variable was 0.33 for 10-year-olds, 0.29 for 14-year-olds and for high school seniors.

The second main attenuation in relationships may stem from incorrectness in the information reported by pupils, especially the 10-year-olds. Some preliminary work was done to check upon the dependability of information reported in student questionnaires, checking

student reports against information gathered from direct contact with parents or from school records. The agreement was good enough to encourage the project to continue to rely upon pupils as the basic source of information about home and family circumstances. But, of course, the agreement was not perfect. And most of the pilot studies were done in developed countries with a relatively high standard of literacy. One must question whether the findings of these studies apply in developing countries where the average level of reading achievement is, as our surveys have indicated, much lower. As we shall see presently, it was in these developing countries, in which reading the the questionnaire items must have presented a very difficult reading task for many young people, that the correlations were lowest.

The third point to be mentioned is that each of the variables represent a specific, limited, and somewhat indirect indicator of the total environment in which the child has grown up. Books represent one resource for intellectual stimulation of the child, but magazines, newspapers, radio and television represent additional channels for intellectual stimulation. And sheer numbers of books tells nothing about the appropriateness of the books to a child or, in fact, what sorts of books are present, or whether anyone ever reads them.

If the indicators are individually of only modest power as predictors of achievement, how powerful are they as a team? This is the problem to which Table 2 provides some answer. The correlations here are for a composite home background variable, but the composite was somewhat differently arrived at for the three subject areas. In particular, items relating to reading resources in the home were ex-

cluded and treated separately in the Literature analyses, whereas they were included for the other two subjects. In general, in the composite variable, component background factors were so weighted as to maximize the correlations of the composite with the achievement measure.

We now see correlations running as high as 0.54, though the typical joint prediction falls somewhere in the 30's. The range of correlations is quite large. How are we to interpret this?

Note first that the correlations are typically much lower at the end of secondary school. In most countries, the group still in school at the end of secondary school is quite a select group--anywhere from 10 to 25 percent of the age group, the remainder having already dropped out of school. Selectivity has operated on the basis of some combination of academic competence and socio-economic status. Most of those from the lower socio-economic groupings have dropped out unless they were especially competent. Thus, the selection has operated both to reduce the range of socio-economic status and leave in school a very non-representative fraction of children from the lower socio-economic strata. As a result, correlations have almost universally dropped. The one exception is the United States, where perhaps 75% of the age group completes secondary school, and where socio-economic variables appear less related to the fact of dropping out of school. In the U.S.A. the prediction of achievement for 18-year-olds is about as accurate as at the earlier levels.

In addition to the difference between the end-of-secondary school and the younger groups, there are notable differences between countries. Considering reading comprehension, one notes composite correlations as

high as 0.54 in Israel, 0.53 in England and 0.51 in Scotland and the United States, while composite correlations reach only 0.14 in Chile (for 10-year-olds) and 0.15 in India. How are those differences to be understood?

One explanation would say that the countries that show the low correlations are very homogeneous; that there is little variation from pupil to pupil in the socio-economic indices in question, and consequently little opportunity for co-variation to appear. This explanation can apparently be rejected. At least, when we took three separate variables for 14-year-olds, and examined the relatonship between national variability (standard deviation of responses on the scaled item) and national correlation with reading comprehension score the correlations were in each instance negative. The countries with the greater variability showed the smaller correlations. This negative value is probably not to be taken seriously, but it does at least argue against any significant positive relationship.

A second explanation would assert that in the developing countries many pupils were simply unable to read and respond meaningfully to the student questionaire. It became clear, as the test papers from the IEA study were processed, that many pupils in the three developing countries (Chile, India and Iran) were responding at or close to a chance level on the reading tests. Tests that were designed to be, and in fact were of appropriate difficulty for the typical pupil in the developed countries of Europe and its derivatives were clearly too difficult for children in these three countries. Since the student questionaire was in a sense a test of reading and of following directions, and very probably as difficult as the 10-year-old version of the Read-

ing Comprehension Test, it seems reasonable to suppose that those who were unable to handle the reading test, responding to it in a random fashion, were also unable to handle the questionnaire and may have responded to its questions in a near-random fashion. Future investigators working with marginally literate populations may need to develop other approaches to obtaining background information about their subjects.

A third explanation, which does not exclude the previous one as a contributory factor, is that the same indicator may have genuinely different significance in different cultures. As an example, we may take number of siblings. This variable showed a negative correlation with achievement in all but one of the developed countries, the one exception being the Flemish-speaking area of Belgium. However, the correlation was positive in several of the developing countries, e.g., India, Iran, and Thailand. Perhaps a small family signifies qualities of restraint, planfulness and concern for children's education in most European-based western countries, but has quite different implications for developing countries in the East. As another illustration, occupational level turns out to be a much weaker predictor in such countries as India, Iran and Thailand. Possibly in these countries there is no clear-cut occupational hierarchy that has the same connotation of economic advantage and cultural stimulation that seems to attach to this hierarchy in the developed European-based countries.

It is hard to judge whether such differences do exist in the basic significance of indicators until it is possible to rule out reading difficulties as a contributing factor. A future study in which information about home and family is gathered at the source, that is, from a parent,

by a trained interviewer, would seem to be required if one is to reach a judgement as to the weight to be attached to the two explanatory factors.

Table 1 provides some evidence on the consistency of the relationship of background variables as one goes from one age level to another. Except for the fact that all correlations are lower for the 18-year-olds, consistency across ages and subjects seems to be the rule, and variations appear to be relatively minor. There is perhaps a suggestion that the availability of reading matter in the home is less important for science achievement than for achievement in reading and literature. Unfortunately, no data were gathered on home variables that might have been more related to science--possibly such an item as the availability of tools and a home workshop, or having a parent who carried out a wide variety of home repairs--so no variables appear that show a stronger relationship to achievement in science. Of course, sex of student is the one major exception to the consistent pattern, since boys tend to do markedly better on the science tests and girls on the literature tests.

There were a few surprises in the relationships that emerged, or sometimes those that failed to emerge. One group of variables was introduced to measure the home's level of interest in schooling and the home press for achievement. These were items that attempted to tap via questionaire some of the aspects of the home that had been found in interview-observation studies to show a strong positive relationship to achievement of a child. There were items such as:

How often does your mother or father help you with your homework?

When you talk at home, do your parents insist that you speak correctly?

When you get home from school, do your parents ask about your schoolwork?

However, examination of Table 1 shows that the correlations in this study were all small and were sometimes negative. In particular, it appears that the pupil's report that his parents help him with his homework is more an indication of childish ineptitude than of parental commitment. The correlation was negative practically without exception for all countries, all subjects and all levels. Perhaps parental behavior as seen and reported by a pupil is quite different from parental behavior as reported by a parent or seen by an adult observer. But more likely the information obtainable by questionnaire is getting at a different type or level of parent involvement than is gotten by more probing approaches.

Table 2 provides some evidence on the consistency of prediction through background variables as one goes from country to country. Attention has already been directed to the relatively low values in Chile, India and Iran, and for all countries but the United States at the end of secondary school, and possible explanations for these results have been proposed. A further question might be: to what extent is a country consistently high or low in the predictability of achievement? As one answer to this, we have computed a coefficient of concordance over several of the better predictors and over the two subject areas of reading and science. Thus, for each predictor the available countries were ranked for size of correlation coeficient, both for 10-year-olds and 14-year-olds and the concordance of the ranks determined. For science the coeficient of concordance was 0.76 and the average rank order correlation was 0.70; for reading the corresponding values were 0.81 and 0.78. Thus, there is a substantial amount of consistency both over predictors and over age groups in the countries in which prediction from background variables is effective. An overall ranking of 13 countries from most to

least predictable would result in the following order:

1. Scotland
2. England
3. Hungary
4. United States
5. Finland
6. Belgium (French-speaking)
7. Chile
8. Sweden
9. Netherlands
10. Italy
11. Iran
12. Belgium (Flemish-speaking)
13. India

It is interesting to speculate on what accounts for this order. As previously noted, prediction was relatively poor in the developing countries, especially Iran and India, and possible reasons have been offered for this finding. One notes that prediction is especially good in the English-speaking countries. This could reflect the fact that all the tests and questionnaires were initially developed in the English language. The tests were slightly more reliable in English-speaking countries, and it is possible that the questionnaire items were somehow clearer, leading to more precise responses. But why does Hungary fall so near the top? Why is Flemish-speaking Belgium so near the bottom?

So far we have considered background factors as predictors of the achievements of individual children. What about the prediction of between-country differences? Do national differences in the availability of books in the home, for example, correspond to national differences

in achievement? Some evidence on this problem is provided in Table 3, where correlations are shown between average reading comprehension score and average score on each of a number of background variables. Correlations are shown with the three developing countries included, and also with these countries removed.

From Table 3 it is apparent that any of a number of background variables corresponds fairly well with average achievement if the three developing countries are included. However, when these three countries are omitted, the correlations are generally quite small, and quite a different set of variables are the best predictors. It is also true that the variables that best differentiate among countries are not the same as those that best differentiate among individuals. For example, among the developed countries number of magazines differentiates better than number of books, whereas for individual pupils the order is quite the reverse. Again, as between countries the report that parents help with homework is a favorable indicator, while as between pupils within a country it is an unfavorable one. As between countries, time devoted to TV and radio is as powerful an indicator as time spent reading for pleasure; for individuals reading time is very much more predictive. It appears that the dynamics of prediction across countries is rather different from the dynamics across individuals. One interpretation would be that indicators of economic development are more potent across countries, whereas indicators of cultural enrichment are more potent across individuals.

In the IEA studies some attention was also paid to school characteristics as indicators of achievement. In those analyses it was extremely important to partial out the influence of background variables of the

sorts considered in this paper. Background factors which gave correlations of around 0.30 as between individuals yielded correlations as high as 0.70 when dealing with average input and average achievement for a school. By comparison, most school variables (that is, variables describing some aspect of schooling within a school) gave small correlations and ones that were erratic and inconsistent from country to country. Thus, in spite of the modest correlations that we obtained for background variables, these seemed to be much more effective predictors than any of the items that described the school as an educational unit. If direct measures had been available of the children as they entered school, even higher correlations would almost certainly have been obtained between pupil input and average achievement. In many countries, of which the United States is one, the input variables delimit rather sharply the range of outputs that it is reasonable to expect for a school. Thus, though the home background factors provide only a rough guide to expected individual performance, they define rather sharply the expected performance of a school.

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Table 1

Median Correlation, Across Countries, of Background Factors and Individual Achievement (Decimal points omitted)

	Reading Comprehension			Science			Literature	
	10	14	18	10	14	18	14	18
Father's occupation	28	29	11	23	23	09	--	--
Father's education	--*	20	17	--	17	10	17	12
Mother's education	--	19	13	--	15	08	15	12
Books in home	25	27	13	23	21	09	23	13
Magazines in home	--	14	08	--	06	07	14	08
Use of Dictionary	11	10	06	09	09	-02	10	09
Family size	-14	-14	-02	-12	-10	-02	-12	-04
Sex of student	02	02	05	-11	-20	-30	21	18
Parents help homework	-03	-08	-06	-06	-11	-07	-06	-05
Parents correct spelling	06	02	-03	04	01	-05	00	01
Parents correct writing	01	01	-02	00	00	-01	04	03
Encourage to read	06	07	04	06	05	-06	07	07
Interested in school	08	10	-01	07	05	-06	07	06
Encourage visit museums	--	05	05	--	03	-04	07	06

*Data not available for this age group or subject

Table 2

Composite Prediction in Each Country and Population
(Decimal points in correlations omitted)

	Reading Comp. vs. Background Composite			Science vs. Home Circumstances			Literature vs. Home Background	
	11	14	18	10	14	18	14	18
Australia	--*	--	--	--	33	11	--	--
Belgium (Fl.)	27	32	34	16	15	--	15	17
Belgium (Fr.)	40	33	22	30	--	--	26	07
Chile	14	42	32	13	26	29	30	21
England	44	53	15	41	45	-02	36	07
Fed. Rep. Ger.	--	--	--	20	31	01	--	--
Finland	38	48	13	23	34	10	30	06
France	--	--	--	--	--	06	--	--
Hungary	45	47	29	25	31	22	--	--
India	15	18	16	07	15	18	--	--
Iran	38	23	22	19	17	09	20	20
Israel	54	54	30	--	--	--	--	--
Italy	31	33	27	18	16	17	21	20
Japan	--	--	--	33	38	--	--	--
Netherlands	35	37	15	30	27	08	--	--
New Zealand	--	41	20	--	33	07	25	08
Scotland	46	51	23	42	48	14	--	--
Sweden	30	41	27	27	28	13	21	11
Thailand	--	--	--	--	31	--	--	--
U.S.A.	42	51	46	40	41	31	32	27

*Data not available in this country for this subject

Table 3

Correlations of Country Mean Reading Comprehension with Other National Variables. Population II

Variable	All 15 Countries	12 Developed Countries
Father's education	.60	.14
Mother's education	.73	.23
Expected education	.67	.30
Hours homework weekly	.25	.19
Hours instruction--mother tongue	.21	.47
Parents help with homework	.53	.13
Parents encourage to read	.56	.04
Parents interested in school	.07	.12
Dictionary available	.09	.25
Number of books in home	.85	.17
Number of magazines	.71	.36
Hours radio or TV	.92	.28
Frequency movie attendance	.23	.07
Hours reading for pleasure	.16	.29